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Project No. 15737

Methods to Reduce Water Infiltration and Recharge of the Northern Shallow Perched Water Zone at INTEC

Idaho Cleanup Project

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5. Summary:

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Record of Decision (ROD) for Operable Unit (OU) 3-13, Group 4, Perched Water, requires that infiltration of water be minimized within the Idaho Nuclear Technology and Engineering Center (INTEC) facility to reduce recharge to the underlying contaminated perched water zones and, thereby, minimize the downward migration of contaminants toward the Snake River Plain Aquifer (SRPA). Actions to reduce recharge were being implemented so that the groundwater quality in the SRPA at the INTEC perimeter fence meets drinking water standards by 2095. Identified recharge sources from the OU 3-13 ROD include precipitation infiltration, INTEC water system leaks, deliberate clean water discharges, and Big Lost River channel infiltration (when flowing).

The results of the OU 3-14 Remedial Investigation (RI) determined that the OU 3-13, Group 4, remedial action objectives (RAOs) have been achieved, meaning that the drinking water standards in the SRPA were predicted to be achieved at the INTEC perimeter fence by 2095. The OU 3-14 RAOs, which require the groundwater quality in the SRPA at INTEC to meet drinking water standards by 2095, were not predicted to be met. Based on the results of perched water monitoring and contaminant transport modeling performed for the OU 3-14 Remedial Investigation/Feasibility Study (RI/FS), additional steps are needed to reduce infiltration and recharge of the northern shallow perched water at INTEC.

The results of contaminant transport modeling performed for the OU 3-14 FS indicated that, if the OU 3-14 RAOs are to be achieved, two conditions must be met: (1) precipitation infiltration through a 10-acre area around the tank farm must be reduced to less than 1 mm/yr and (2) anthropogenic water infiltration beneath northern INTEC must be reduced to less than 50% of the assumed current value (10 mgy). The first condition (reduction in precipitation infiltration) equates to a water volume of approximately 2.3 mgy, while the second condition equates to approximately 5 mgy of reduced recharge. Taken together, the modeling results suggest that water infiltration beneath northern INTEC must be reduced by approximately 7 mgy in order to meet the OU 3-14 RAOs.

This document identifies potential actions that could be taken to further reduce water infiltration and recharge of the perched water zones beneath the northern portion of INTEC. It does not include actions associated with precipitation infiltration through a 10-acre area around the tank farm since that is addressed in the OU 3-14 FS. A facilitated workshop was performed to assess the effectiveness of several possible actions. The ranking and prioritization of the potential actions are based on five evaluation criteria: proximity to contaminant sources, anticipated volume reduction of perched water recharge attributed to the action, time required to implement, confidence, and cost. Alternatives that were ranked highest (most worthwhile) were those that were close to contaminant source areas, result in a large reduction in recharge, can be implemented soon, have a high confidence, and are cost-effective (or some combination thereof).

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Following this workshop, a meeting was held to identify the most cost-effective actions that could be undertaken within an active facility (Phase I actions). The potential actions were subsequently discussed at an Agency meeting on May 31, 2006. Based on these meetings, the following actions were recommended for Phase I implementation:

1. Capture roof run-off from selected existing building downspouts within the secondary recharge control zone (SRCZ) and route water to lined ditches and evaporation pond
2. Perform pipeline valve isolation tests and/or pipeline hydrostatic tests to identify leaks in suspect areas
3. Eliminate lawn watering
4. Eliminate steam condensate drip-leg discharges to ground
5. Conduct regular water balance calculations to highlight changes in system flows that could indicate leaks
6. Install asphalt or concrete in unlined north ditch to eliminate infiltration
7. Install two additional flow meters to improve confidence in water balance calculations
8. Install telemetry for real-time water level monitoring in selected perched water monitoring wells
9. Extend pavement and/or lined ditches to reduce storm water infiltration
10. Improve surface water drainage along Olive Avenue to reduce or eliminate ponding and infiltration.

6. Review (R) and Approval (A) and Acceptance (Ac) Signatures:
(See instructions for definitions of terms and significance of signatures.)

	R/A	Typed Name/Organization	Signature	Date
Performer/ Author	N/A	Jeffrey Forbes	Jeffrey Forbes	8-7-06
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Independent Peer Reviewer (if applicable)	R	Lorie Cahn	Lorie Cahn	8-7-06
Approver	A	Marty Doornbos	[illegible]	8-9-06
Requestor (if applicable)	Ac	Howard Forsythe	[illegible] for H. Forsythe	8-9-06
Doc. Control	Ac	Carly Anderson	Carly Anderson	8/9/06

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FIGURES

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Methods to Reduce Water Infiltration and Recharge of the Northern Shallow Perched Water Zone at INTEC

1. INTRODUCTION

The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Record of Decision (ROD) for Operable Unit (OU) 3-13, Group 4, Perched Water (DOE-ID 1999) requires that infiltration of water be minimized within the Idaho Nuclear Technology and Engineering Center (INTEC) facility to reduce recharge to the underlying contaminated perched water zones and, thereby, minimize the downward migration of contaminants toward the Snake River Plain Aquifer (SRPA).

In October 1999, the ROD was issued for OU 3-13 (DOE-ID 1999) and specified remedial actions for the INTEC perched water (Group 4) and groundwater (Group 5). The remedy selected for perched water (Group 4) is institutional controls with aquifer recharge controls (DOE-ID 1999). Remedial action objectives (RAOs) established for perched water (Group 4) were

3a. Prevent migration of radionuclides from perched water in concentrations that would cause SRPA groundwater outside the current INTEC security fence to exceed a cumulative carcinogenic risk of 1 × 10-4, a total Hazard Index (HI) of 1; or applicable State of Idaho groundwater quality standards (i.e., MCLs) in 2095 and beyond.

3b. Prevent excavations into and drilling through the contaminated earth materials remaining after the desaturation of the perched water to prevent exposure of the public to a cumulative carcinogenic risk of 1 × 10-4, a total Hazard Index (HI) of 1; and protection of the SRPA to meet Objective 3a listed above.

In order to meet the RAOs, specific tasks called out in the ROD to reduce infiltration and recharge of the perched water beneath INTEC were

- Relocate percolation ponds (away from INTEC) by December 2003
- Minimize recharge to the perched water from lawn irrigation (if necessary)
- Line Big Lost River (BLR) channel segment (if necessary)
- Implement additional infiltration controls if drain out of perched water does not occur within 5 years of removing the percolation ponds (Phase II to Group 4 remedy)
- Measure moisture content and contaminant of concern (COC) concentration(s) in the perched water zones to determine if water contents and contaminant fluxes are decreasing as predicted.

As of the end of 2004, activities completed to implement the remedy and reduce recharge include

- Percolation ponds permanently taken out of service on August 26, 2002, reducing water infiltration at INTEC by ~1 mgd
- Sewage effluent redirected to new percolation ponds on December 2, 2004, reducing infiltration by ~40,000 gpd

- Tank Farm Interim Action (TFIA) project installed concrete-lined ditches around the tank farm to reduce water infiltration (2003–2004)

- Subsurface injection of steam condensate was reduced from ~2,013 gpd (1997) to ~80 gpd (2003)

- Lawn irrigation reduced through elimination of some grassed lawn areas.

The INTEC contaminant transport model was updated during 2005 as part of the OU 3-14 Remedial Investigation/Feasibility Study (RI/FS). The results of the modeling indicate that the OU 3-13 RAOs will be achieved (no exceedance of maximum contaminant levels [MCLs] in the SRPA outside current security fence beyond 2095) but that additional recharge controls will be required to meet the more restrictive RAOs established for OU 3-14 for the SRPA inside the security fence. This document is intended to address the need for these additional recharge controls.

A meeting was held in Boise, Idaho, on February 7, 2006, to discuss ongoing groundwater and perched water activities at INTEC being conducted under CERCLA OUs 3-13 and 3-14. The meeting was attended by representatives of the Department of Energy (DOE), Environmental Protection Agency (EPA), Idaho Department of Environmental Quality (DEQ), and CH2M-WG Idaho (CWI). Among other items, the meeting included a presentation that summarized the current conceptual model regarding perched water beneath INTEC and addressed the reasons why the northern shallow perched water has persisted during 2000–2005, in spite of the drought during that time. It appears that a combination of (1) precipitation infiltration (rainfall and snowmelt) and (2) discharges and leaks of water from facility pipelines (anthropogenic water) are responsible for the continued recharge of the perched water beneath the northern part of INTEC. In addition, possible methods of reducing infiltration of precipitation and anthropogenic water beneath INTEC were discussed. This report summarizes the information presented regarding potential methods to reduce perched water recharge.

2. INTEC PERCHED WATER ZONES

Perched water zones have been present at various depths within the 460-ft-thick vadose zone beneath INTEC since at least as early as 1956 (Robertson, Schoen, and Barraclough 1974). Figure 1 shows, schematically, the occurrence of perched water beneath the INTEC facility. Perched water monitoring and remediation at INTEC are being performed under Waste Area Group (WAG) 3, OU 3-13, Group 4 (Perched Water). A remedy for the perched water was established in the OU 3-13 ROD (DOE-ID 1999). The OU 3-13 ROD requires that perched water zones be monitored to assess perched water drainout and downward contaminant flux to the SRPA (DOE-ID 1999). The Long-Term Monitoring Plan for OU 3-13, Group 4, Perched Water (DOE-ID 2005a) specifies the wells to be sampled and the required analyses, based on the requirements in the OU 3-13 ROD.

Perched water has formed in two distinct geographic areas: northern and southern INTEC. The southern perched water system mostly dissipated following relocation of the INTEC percolation ponds in August 2002. In contrast, the northern perched water has persisted since relocation of the percolation ponds. The northern perched water system includes both shallow and deep perched water zones; the northern shallow perched water is the focus of the remainder of this report.

The lateral extent of the northern shallow perched water system is shown in Figure 2 and has been further divided into the upper shallow and lower shallow perched zones, which generally correspond with the 110- and 140-ft sedimentary interbeds that underlie the site. The volume of the northern perched water is estimated to range from approximately 5 to 20 million gal and varies seasonally in response to wet and dry periods (DOE-ID 2006a).

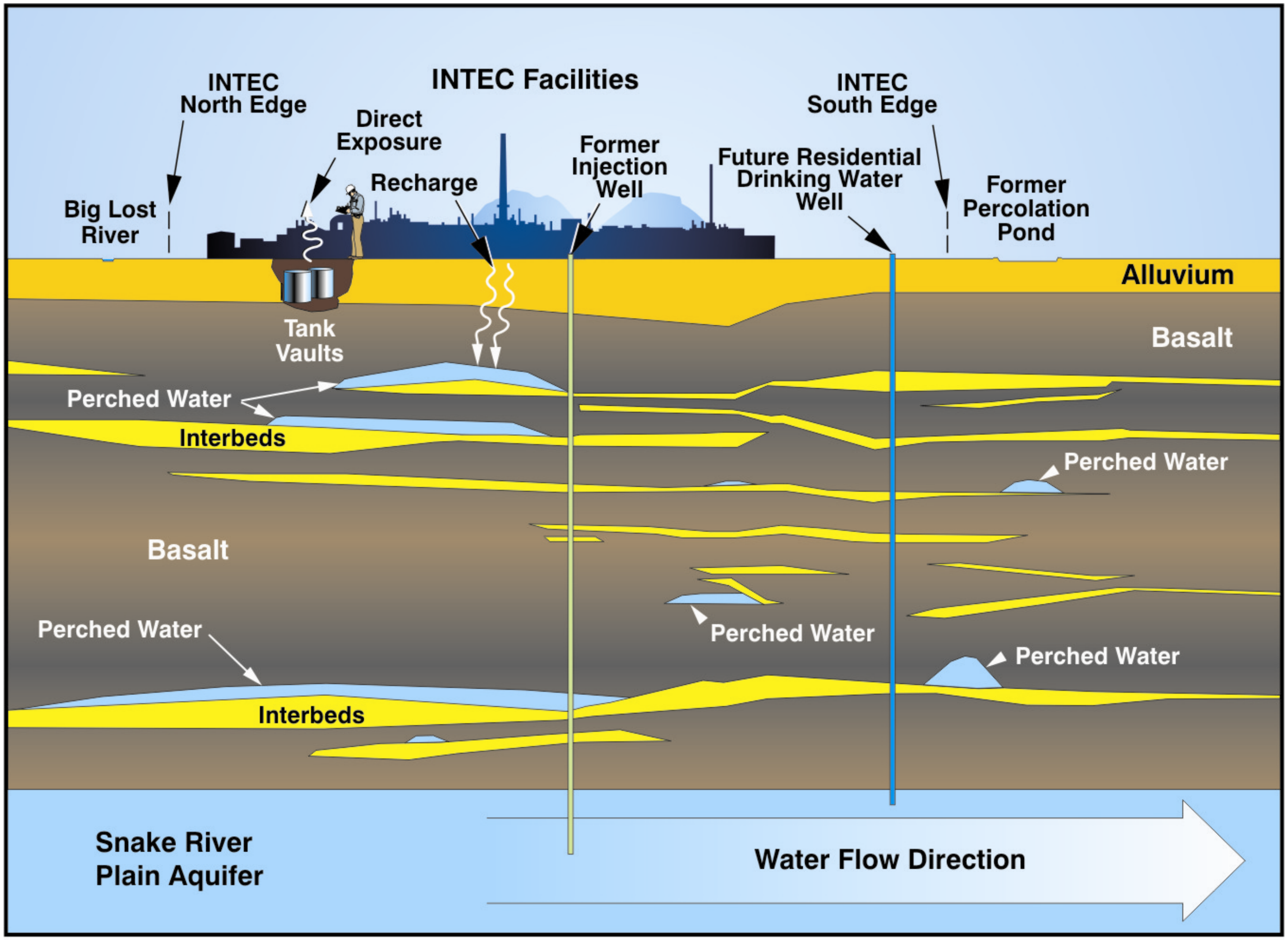

Figure 1. INTEC subsurface hydrogeologic conceptual model.

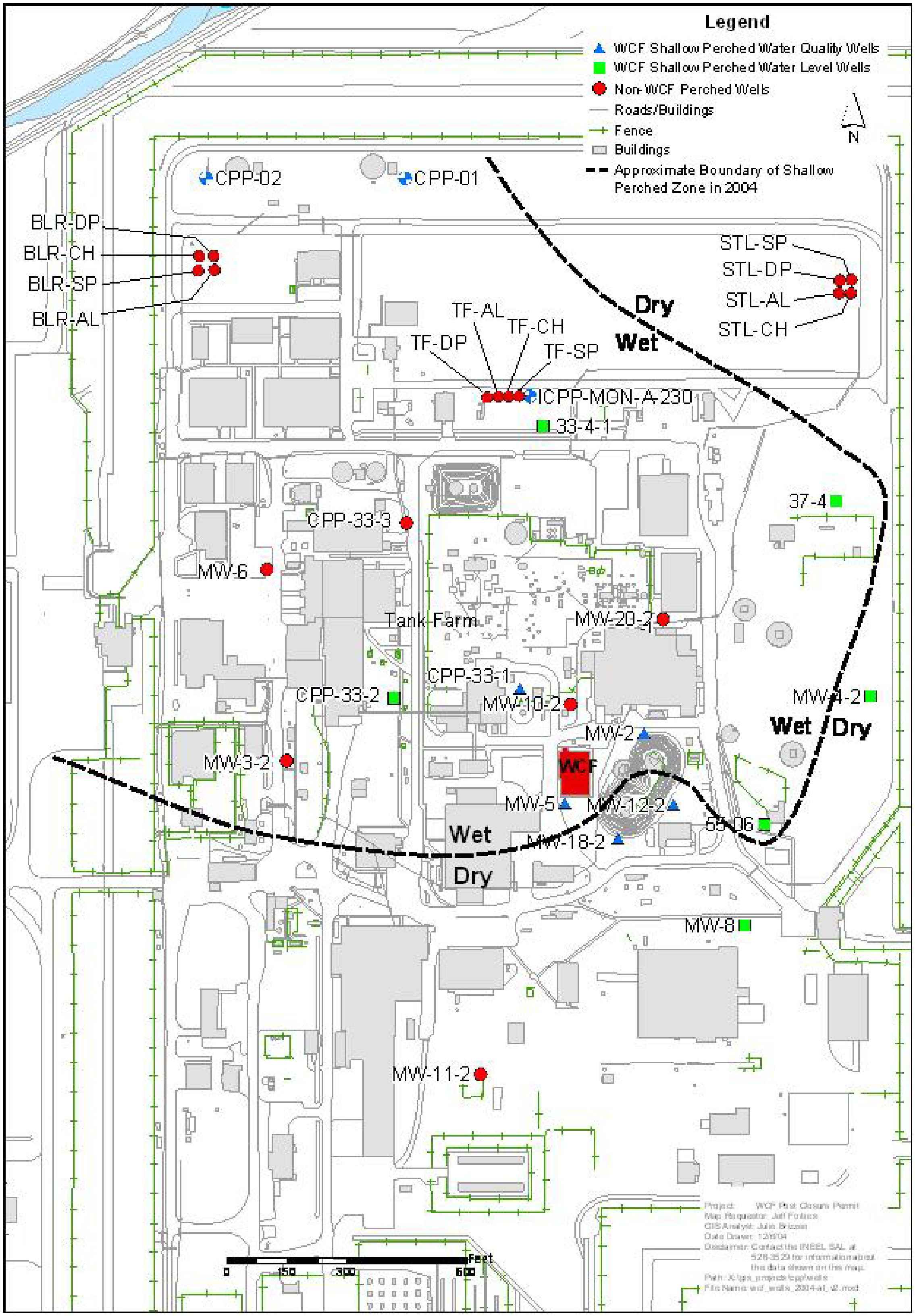

Figure 2. Approximate lateral extent of northern shallow perched water beneath INTEC during 2004-2005.

Based upon OU 3-14 modeling, the perched water COC at INTEC is Sr-90. The reasons for this include (1) large amounts of Sr-90 were present in past liquid waste releases that occurred in the tank farm area; (2) Sr-90 can remain somewhat mobile under certain subsurface conditions (unlike many other fission products); (3) Sr-90 has a long enough half-life (29 years) that it persists for several hundred years, yet short enough that it has a relatively high specific activity; and (4) the drinking water standard for Sr-90 is relatively low (MCL = 8 pCi/L). The total (undecayed) inventory of Sr-90 in the known historical liquid releases at the tank farm is approximately 18,000 Ci (DOE-NE-ID 2006), which equates to approximately 9,000 Ci Sr-90 remaining in 2006. As a result of the factors listed above, Sr-90 is the constituent whose concentrations most greatly exceed its MCL in perched water at INTEC and, therefore, presents the greatest threat to groundwater quality in the underlying SRPA. Sr-90 is the only constituent predicted by the model to exceed its MCL beyond the year 2095. Other radionuclides present in perched water include Tc 99, I-129, tritium, and Cs-137. However, the results of contaminant transport modeling performed for the OU 3-14 Remedial Investigation/Baseline Risk Assessment (RI/BRA) (DOE-NE-ID 2006) indicate that these other radionuclides will not exceed their respective MCLs in the SRPA in 2095 and beyond.

The northern shallow perched water contains the highest radionuclide concentrations at INTEC, with Sr-90 being the principal COC. Sr-90 was detected in perched water at concentrations exceeding 100,000 pCi/L (much higher than any other radionuclide) and was present in nearly all the northern perched water wells. Eleven of the 22 perched water wells sampled during 2004 exceeded the Sr-90 MCL of 8 pCi/L. The highest Sr-90 concentrations were observed in upper shallow perched wells located southeast of the tank farm. Lower concentrations have been observed to the northwest of the tank farm (toward the BLR) and to the northeast (toward the Sewage Treatment Plant).

3. PERCHED WATER RECHARGE SOURCES

The northern perched water system is more complex than the southern perched water system in that the recharge sources are not as apparent. In the northern INTEC, the most obvious recharge sources that have historically been present include the BLR at the northwest corner of the facility and the Sewage Treatment Plant infiltration trenches located outside the northeast corner of INTEC. However, the BLR did not flow from May 2000 through May 2005, and the Sewage Treatment Plant effluent was routed to the new percolation ponds in December 2004. Therefore, as of the end of 2004, the BLR and Sewage Treatment Plant were not contributing to perched water recharge. Nevertheless, the northern shallow perched water has continued to persist, and other recharge sources must therefore be responsible. Figure 3 shows a hydrograph for selected shallow perched water monitor wells located in the northern part of INTEC. The continued presence of perched water beneath the northern portion of INTEC is attributed to infiltration of (1) precipitation and (2) anthropogenic water, including both intentional discharges and pipeline leaks. The following sections give additional details regarding these two recharge sources.

The OU 3-14 modeling indicated that reducing infiltration through a 10-acre area to 1 mm/yr would sufficiently retard Sr-90 migration to the SRPA to ensure future groundwater concentrations would meet drinking water standards in 2095 and beyond. This 10-acre area, denoted as the primary recharge control zone (PRCZ), is roughly equivalent to the area used in the model. In addition, a secondary recharge control zone (SRCZ) was established to identify an area for the 50% reduction in anthropogenic water. Figure 4 shows the proposed boundaries of the PRCZ and SRCZ areas, which encompass areas of 9.5 and 32.2 acres, respectively. It is envisioned that a graded approach will be used with the most aggressive efforts focused on the PRCZ, and somewhat less aggressive actions will be taken within the surrounding SRCZ.

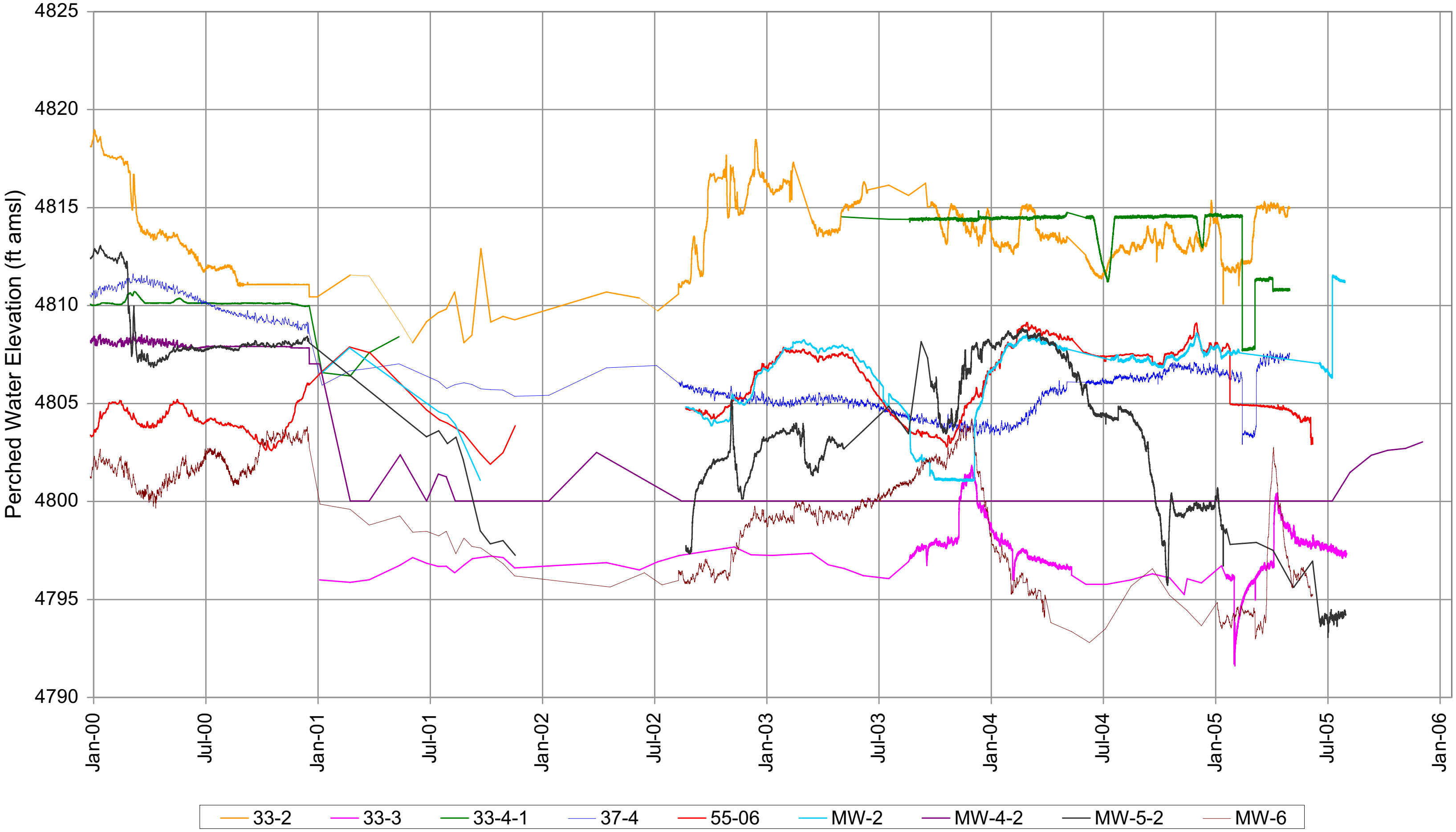

Figure 3. Hydrographs for selected northern INTEC shallow perched wells.

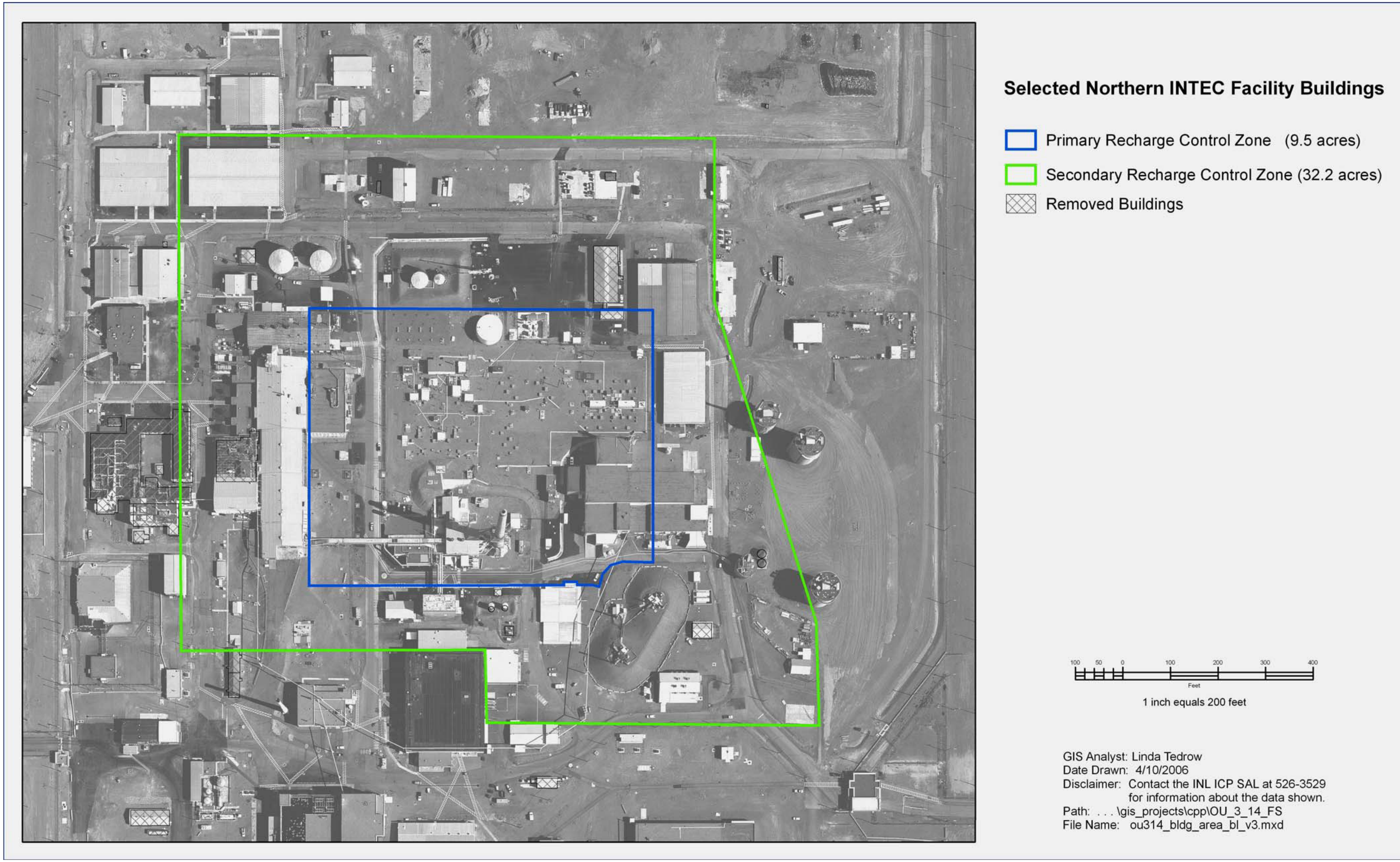

Figure 4. Map showing proposed primary and secondary recharge control zones.

3.1 Precipitation Infiltration

It is believed that a large fraction of the water from rainfall and snow within INTEC infiltrates into the ground and ultimately recharges the perched water and the underlying SRPA. In contrast with the surrounding undisturbed desert areas, reasons for the enhanced infiltration of precipitation within the INTEC facility include (1) lack of vegetation (no transpiration), (2) presence of high-permeability gravelly alluvium at the surface (no soil horizon) that permits rapid infiltration of precipitation, (3) presence of large areas with pavement or buildings that shed and focus water to the perimeter, (4) presence of closed depressions and unlined ditches that cause ponding and rapid infiltration of storm water, and (5) presence of plowed snow accumulation areas that concentrate melt water during the spring melt.

Average annual precipitation at the Central Facilities Area during the period 1950 to 2004 was 22.1 cm/year (8.51 in./year), with the wettest months typically in May and June. An assessment of precipitation infiltration in the tank farm area was performed as part of the OU 3-14 contaminant transport modeling (DOE-NE-ID 2006). The infiltration assessment indicated that approximately 85% of the total precipitation, or 18 cm/year (7.1 in./year), is believed to infiltrate into the ground. This equates to an infiltration rate of approximately 193,000 gal/acre/year. The total fenced area of INTEC is approximately 175 acres. Assuming an even areal distribution, precipitation infiltration for the entire facility totals approximately 34 mgy. The area of northern INTEC (north of CPP-666) is approximately 95 acres; thus, the annual volume of precipitation infiltration within the northern INTEC area is approximately 18 mgy. This volume is comparable to estimates of the upper shallow perched water volume (6 to 18 M gal). Taken together, this information indicates that the upper shallow perched water is being continuously replaced by recharge, and the mean residence time for the upper shallow perched water is likely less than 1 year. The area of the SRCZ is approximately 32.2 acres, and the estimated volume of precipitation infiltration within the SRCZ is 6.2 mgy.

A recent project to reduce infiltration in the northern part of INTEC was completed in 2004 as part of the TFIA (DOE-NE-ID 2006). This work included grading and constructing new ditches, lining the existing ditches with concrete, installing a trench drain along Beech Street, replacing existing culverts with larger culverts to accommodate the expected increase in storm water flow, and constructing a large double-lined storm water evaporation pond outside the INTEC fence immediately east of the facility. In addition, areas inside the tank farm were covered with asphalt, including CERCLA soil contamination areas CPP-31, CPP-28, and CPP-79. Selected unpaved/gravel surfaces within the tank farm and surrounding the tank farm were sealed with asphalt to prevent water infiltration and divert surface water toward the storm water collection system. Additional areas outside the tank farm were covered with asphalt to route run-off to nearby lined storm water collection ditches. Figure 5 shows the configuration of the TFIA.

3.2 Infiltration of Anthropogenic Water

Anthropogenic water includes intentional discharges, such as lawn watering, fire hydrant testing, cooling water discharges, and septic system leachfields, plus accidental or unknown leaks from underground water pipelines. Descriptions of some known pipeline leaks during 2005 can be found in the INTEC Water Balance Report (DOE-ID 2005b). Table 1 summarizes current estimates of water recharge rates from selected anthropogenic and precipitation sources.

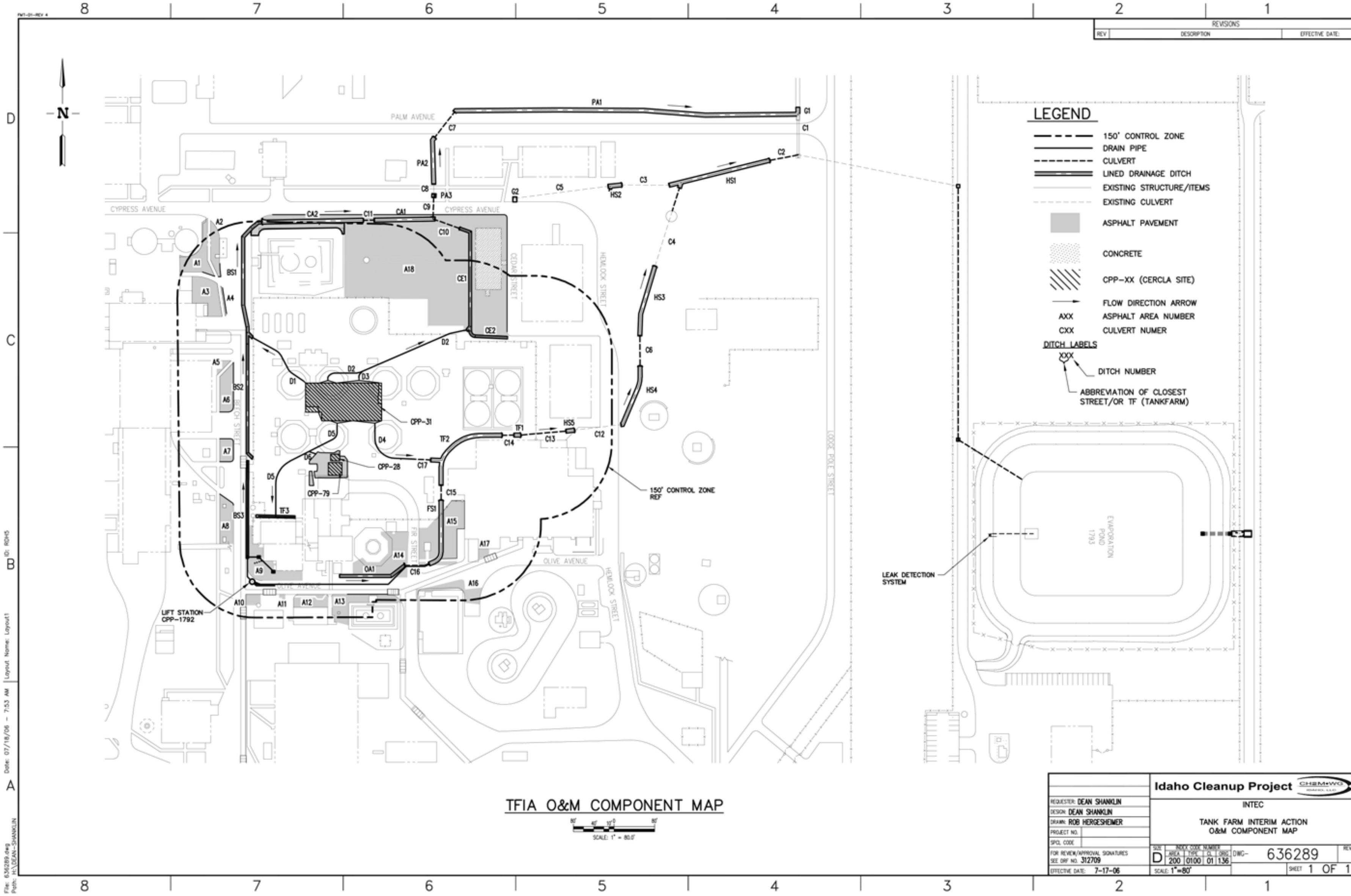

Figure 5. Configuration of Tank Farm Interim Action drainage system.

Table 1. Summary of selected INTEC water infiltration sources.

Recharge Source	Estimated Recharge Rate (mgy)	Location or Area	Information Source
Precipitation infiltration	6.2	Entire SRCZ (32.2 acre)	DOE-ID (2004)
Known pipeline leaks	5+	Entire INTEC facility	DOE-ID (2005b), Appendix D
Lawn irrigation	3.4	Northern INTEC (north of CPP-666)	EDF-6072, Table 4
Roof run-off	To be determined	Entire SRCZ	—
Fire pump cooling water	0.31	Unlined ditch near north fenceline	EDF-6072, Section 4.3
Septic leachfields	0.17	Central INTEC area outside SRCZ	EDF-6072, Table 4
Fire hydrant testing	0.05	Entire INTEC facility	EDF-6072, Table 4
Steam drip legs	0.015	Beech Street	EDF-6072, Table 4
Building heat pumps	0.001	CPP-697	EDF-6072, Table 4
Raw water backup pump	0.22	Unlined ditch north of CPP-614	EDF-6072, Table 4

Between 2002 and 2004, several significant anthropogenic water recharge sources at INTEC were relocated or eliminated, including the service waste percolation ponds and Sewage Treatment Plant infiltration trenches. The two service waste percolation ponds that were located immediately south of INTEC were permanently taken out of service on August 26, 2002. Since that date, approximately 1 mgd of service waste flow has been sent to the new percolation ponds located about 2 miles west of INTEC. The relocation of the percolation ponds in 2002 represents a large reduction in subsurface recharge and resulted in rapid drain out of perched water beneath much of the southern part of INTEC (Cahn and Ansley 2004). However, the relocation of the percolation ponds has had essentially no effect on perched water levels in the northern part of INTEC (DOE-NE-ID 2004).

On December 2, 2004, the Sewage Treatment Plant wastewater effluent discharge line was tied into the service waste line, and the treated wastewater effluent began flowing to the new percolation ponds 2 miles to the west of INTEC. At the same time, the four wastewater infiltration trenches near the northeast corner of INTEC were permanently taken out of service. This change reduced infiltration rates in the northern part of INTEC by up to 40,000 gpd. Elimination of the recharge source at the Sewage Treatment Plant caused one nearby perched monitoring well to go dry (MW-24) but had no measurable effect on the northern perched water inside the INTEC security fence. Subsurface injection of waste steam condensate has also been significantly reduced in recent years. Furthermore, infiltration from landscape irrigation has been reduced as a result of elimination of several grassed lawn areas within the facility. These actions did not cause a significant reduction in shallow perched water volume.

INTEC water distribution system flow meters were installed or upgraded during 2004, and water balance calculations were completed for the first half of 2005 (DOE-ID 2005b). The water balance report concluded that

- About 1% of overall water use at INTEC is discharged to ground from known leaks
- About 0.5% of overall water use at INTEC is discharged to ground from intentional discharges (includes irrigation, septic discharges, fire water operational discharges, etc.)
- About 9% of overall use is unaccounted water (including metering accuracy, unmetered fire water flows, and unknown leaks).

The worst-case scenario, then, would be to assume that all "unaccounted water" is discharged to ground via unknown underground pipeline leaks. Under this scenario, and ignoring evaporation, anthropogenic recharge could total up to 10.5% of overall INTEC water usage. Total plant water usage for 2004 was approximately 495 M gal, with potable water use being about 8 M gal of this total. Therefore, the maximum possible anthropogenic recharge rate would be 52 mgy. The actual magnitude of anthropogenic infiltration is likely much lower. This worst-case scenario assumes that (1) all unaccounted water goes to ground, (2) the data from the 6-month water balance are typical, and (3) 2004 total water usage is typical. The maximum possible annual anthropogenic recharge (52 mgy) is larger than the current estimate of facility-wide precipitation infiltration (34 mgy). Based on the higher density of utilities and activities in the northern portion of INTEC, the majority of anthropogenic recharge is believed to occur in this same general area. Even if anthropogenic recharge is assumed to include only the known 2005 discharges and leaks (1.5% of water use), this volume (5 mgy) (DOE-ID 2005b) is approximately equal to the volume of the upper shallow perched water. Therefore, the mean residence time for water in the upper shallow perched zone must be short, probably less than 1 year.

Subsequent to the early 2005 water balance (DOE-ID 2005b), additional quarterly water balance reports were prepared for the periods of July–September and October–December 2005 (Varvel 2006a, b). These water balance calculations indicate that the "unaccounted water" during these two periods was

7.1% and 6.8% of total water use, respectively. Multiplying these values times the total 2004 INTEC water usage (495 M gal) suggests that the maximum possible anthropogenic recharge rate would be approximately 35 mgy, which is similar to the estimate of total precipitation infiltration for the entire facility. The actual anthropogenic recharge rate would be less, but this calculation provides an upper limit.

4. METHODS TO REDUCE WATER INFILTRATION BENEATH NORTHERN INTEC

As discussed in the preceding sections, the contaminated shallow perched water has persisted beneath the northern portion of INTEC in spite of efforts over the past several years to reduce water infiltration. As a result of the OU 3-14 RI modeling, it has been determined that further actions are necessary within the area around the tank farm to further reduce infiltration, recharge, and contaminant migration. Table 2 lists potential actions that could be taken in an attempt to reduce infiltration and recharge beneath northern INTEC. The actions are listed in no particular order and include those discussed at the Agency meeting in Boise on February 7, 2006.

4.1 Facilitated Workshop to Prioritize Actions to Reduce Water Infiltration

In an attempt to rate the effectiveness of and prioritize, among the possible actions to reduce infiltration and perched water recharge, a facilitated workshop was held at the Idaho National Laboratory (INL) Site on March 16, 2006. The meeting was facilitated by Mr. Buck West (INL) and employed computer-assisted facilitation using the GroupSystems *Meeting Room* software, which permits anonymous voting for the various alternative actions by each meeting participant using laptop computers. A complete record of the workshop is included in Appendix A of this report.

The potential actions considered during the workshop are listed in Table 2. Each alternative action was discussed briefly by the participants. After all of the potential actions had been discussed, each participant was asked to estimate the effectiveness of each action based on five evaluation criteria:

- Life-cycle cost of implementing the proposed action
- Proximity of the action to contaminant sources at or near the tank farm
- Volume reduction of perched water recharge per year attributed to the action
- Time required to implement action
- Confidence that the action will significantly reduce infiltration and recharge.

The ranges established for the five evaluation criteria were as follows:

- Proximity: inside tank farm (close) to outside INTEC (far from source areas)
- Volume reduction: <100,000 gpy (very small volume) to >1,000,000 gpy (very large volume)
- Time until implementation: <3 years (very soon) to >7 years (far in the future)
- Confidence in recharge reduction of shallow perched water: <10% (low) to 100% (high)
- Life-cycle cost: <$100K (relatively inexpensive) to >$1M (very costly).

Table 2. Potential actions to reduce water infiltration beneath northern INTEC.

Potential Actions to Reduce Precipitation Infiltration	
1	Expand paved areas within the SRCZ and extend concrete-lined ditches within the SRCZ
2	Extend concrete-lined ditches to areas further away from tank farm
3	Install asphalt or concrete in unlined north ditch to eliminate infiltration
4	Capture roof run-off from downspouts within the SRCZ and route water to lined ditches and evaporation pond
5	Establish snow accumulation areas that drain to existing lined ditches and evaporation pond
6	Seal selected lift station bottom drains and/or upgrade existing storm water drainage system
7	Regrade bare gravel areas to north and east of the SRCZ and install asphalt or concrete in unlined north ditch
8	Maintain and/or upgrade existing storm water drainage system south and west of the SRCZ and along Olive Avenue
9	Line segment of BLR channel to eliminate streambed infiltration
10	Regrade bare gravel areas inside the SRCZ to reduce ponding and improve drainage
11	Revegetate bare gravel areas outside the SRCZ with dryland plant species to increase transpiration
12	Apply fixative on bare gravel areas to reduce water infiltration
Potential Actions to Reduce Anthropogenic Water Infiltration	
13	Eliminate lawn watering
14	Properly maintain lawns to eliminate overwatering
15	Eliminate remaining septic tank leachfields (CPP-626, CPP-655, CPP-656)
16	Eliminate CPP-697 heat pump discharge to ground
17	Eliminate steam condensate drip leg discharges to ground
18	Capture fire water discharges during annual fire hydrant testing
19	Eliminate unnecessary cooling water flows to service waste by 400 to 500 gpm
20	Eliminate cooling water discharges to unlined ditches
21	Install additional flow meters on key water distribution pipelines
22	Upgrade existing water system flow meters with telemetry for real-time flow data monitoring
23	Conduct regular water balance calculations to highlight changes in system flows that could indicate leaks
24	Equip selected perched monitor wells with telemetry for real-time water level monitoring and immediate notification of sudden water level increases that could indicate nearby pipeline leaks
25	Perform pipeline valve isolation tests and/or pipeline hydrostatic tests to identify leaks in suspect areas
26	Perform pipeline leak testing using tracers (e.g., helium gas) to pinpoint leaks on selected lines (five tests/year)

In general, alternatives that were ranked highest (most worthwhile) were those that (a) were thought to be close to contaminant source areas, (b) result in a large reduction in recharge, (c) are able to be implemented soon, (d) had high confidence, and (e) were most cost-effective (or some combination thereof). Details regarding the evaluation criteria weightings and final scoring of the various alternatives are provided in Appendix A.

Figure 6 shows graphically the rankings of the various actions (alternatives), based on the March 16, 2006, workshop scores. It should be emphasized that these rankings are based on the opinions of the individuals present at the workshop and given the information available at that time. If additional information had been available or if the list of participants had been different, different scorings and recommendations could have resulted.

5. CONCLUSIONS

Following this workshop, a meeting was held at INTEC to discuss the actions that could be implemented within an active facility with ongoing operations. The objective of this meeting was to identify the actions that could be implemented as part of the Phase I remedy. Based on this meeting, and a subsequent Agency meeting in Idaho Falls on May 31, 2006, the following actions were recommended for possible implementation:

1. Capture roof run-off from selected existing building downspouts within the SRCZ and route water to lined ditches and evaporation pond

2. Perform pipeline valve isolation tests and/or pipeline hydrostatic tests to identify leaks in suspect areas

3. Eliminate lawn watering

4. Eliminate steam condensate drip leg discharges to ground

5. Conduct regular water balance calculations to highlight changes in system flows that could indicate leaks

6. Install asphalt or concrete in unlined north ditch to eliminate infiltration

7. Install two additional flow meters to improve confidence in water balance calculations

8. Install telemetry for real-time water level monitoring in selected perched water wells

9. Extend pavement and/or lined ditches to reduce storm water infiltration

10. Improve surface water drainage along Olive Avenue to reduce or eliminate ponding and infiltration.

Rough order-of-magnitude cost estimates for these 10 actions are included in Appendix B. Other than the 10 actions listed above, the remaining actions shown in Figure 6 were deemed to be either less cost-effective or to have limited influence with respect to reducing recharge to the shallow perched water. Therefore, these other actions are not proposed for implementation during Phase I.

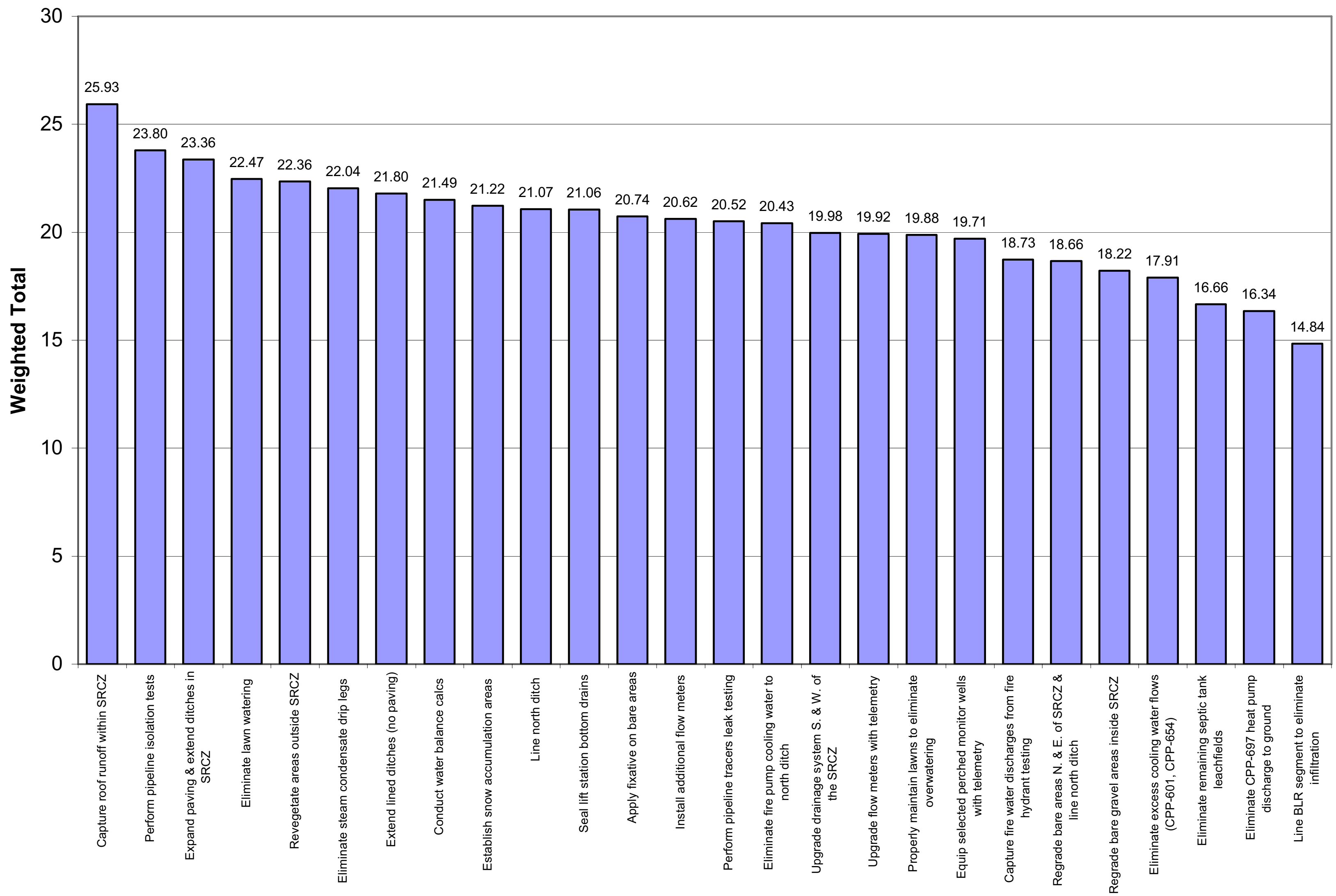

Figure 6. Ranking of actions to reduce water infiltration.

The results of contaminant transport modeling performed for the OU 3-14 FS (DOE-ID 2006b) indicated that if the OU 3-14 RAOs are to be achieved, two conditions must be met: (1) precipitation infiltration through a 10-acre area (PRCZ) around the tank farm must be reduced to less than 1 mm/yr and (2) anthropogenic water infiltration beneath northern INTEC must be reduced to less than 50% of the assumed current value (10 mgy). The first condition (reduction in precipitation infiltration) equates to a water volume of approximately 2.3 M mgy and is addressed in the OU 3-14 FS, while the second condition equates to approximately 5 mgy of reduced recharge. Taken together, the modeling results suggest that water infiltration beneath northern INTEC must be reduced by approximately 7 mgy in order to meet the OU 3-14 RAOs. While it is difficult to quantify how much infiltration reduction will be achieved by some of the actions selected above (e.g., pipeline leak detection and repair), the information in Table 1 suggests that recharge rates could be reduced by at least 8 mgy by eliminating lawn watering and locating and repairing pipeline leaks. Therefore, the ten actions selected above appear adequate to achieve the necessary reduction in recharge rates.

It is beyond the scope of this EDF report to make decisions regarding future CERCLA actions. Such decisions must be made following public comment on the Proposed Plan. It is anticipated that the ROD will select a remedy (such as recharge controls) and set performance criteria and that the RD/RA documents will develop a more detailed engineering design. As such, the information and recommendations in this report are intended to stimulate and guide subsequent discussions that hopefully will result in identifying the best path forward to further reducing water infiltration and contaminant migration at INTEC.

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